

**IN THE UNITED STATES  
PATENT AND TRADEMARK OFFICE**

**TITLE:**

**WATER WELL PUMP**

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## **BACKGROUND OF THE INVENTION**

This application claims priority to U.S. Provisional Application Serial No. 60/430,901 filed December 4, 2002.

### **1. Field of the Invention**

The present invention relates generally to a water well pump.

### **2. Background Information**

All too often, water is taken for granted. Most well pumps last for years, and homeowners never give much thought to hard-working pumps that faithfully kick in every time a homeowner takes a shower, does laundry, or runs the dishwasher. Well pumps are the modern day equivalent of windmills, which were used to move water from one place to another over one hundred years ago. Like windmills, well pumps are particularly handy for irrigating crops, providing livestock with water, supplying water to remote locations, or for acting as heating and cooling mechanisms for geothermal systems. There are two general types of well pumps: submersible and jet.

About sixty percent of home wells in the U.S. use electric submersible pumps. Submersible well pumps are used underwater in wells. A small electric motor may be installed in the well shaft, usually below the pump itself, and an electric cable is attached to the motor. Piping is then fitted from the pump, through the length of the shaft and into the home. Submersible well pumps may be set hundreds of feet deep to the water in a well. When the pump is activated, the motor pushes water up out of the well. Submersible pumps are long cylinders usually three to five inches in diameter and

1 two to four feet long. Well pumps may be powered by alternating current (AC), solar  
2 power, wind power, water power, or even manually.

3 One type of submersible pump is a reciprocating plunger well pump. Various  
4 designs of reciprocating plunger well pumps have been developed of the general type  
5 wherein the pump is mounted at the lower distal end of an elongated well tubing string  
6 and includes a reciprocating plunger or piston connected to an elongated rod extending  
7 to an actuating mechanism at the earth's surface. The pumps also include a cylinder in  
8 which the plunger reciprocates to displace fluid from a plunger cavity and is controlled  
9 by cavity inlet and discharge valves mounted on the cylinder and on the plunger,  
10 respectively.

11 In spite of the relatively highly developed state of the art in reciprocating plunger  
12 well pumps, certain problems in the operation of these pumps persist. In particular,  
13 when pumps are stopped, water hammer develops, which is an unwanted noisy and  
14 shaking condition of the pump. Further, the balls in many pumps are steel. Therefore,  
15 when the seat that the ball rests on becomes worn and damaged by the constant  
16 beating from the ball, erosion from abrasives, corrosion, chipping, or flaking, the steel  
17 balls cannot seal the pump and there is unwanted water leakage. Further, there are  
18 many instances when water well pumps must be assembled and installed in a short  
19 amount of time such as in emergency situations and field operations using materials  
20 available in the given area and usually without electricity. The unique design of the

1 present invention allows it to be made and used in a short amount of time and requires  
2 no electricity or adaptors to assemble which is in direct contrast to the prior art.

3       Efforts to eliminate the above-mentioned problems while providing a well pump  
4 which is inexpensive to manufacture and is reliable in operation have not been entirely  
5 successful and further improvements in such pumps have long been sought. It is to  
6 these ends that the present invention has been developed for use in water wells and oil  
7 wells.

### 8 9                                   **SUMMARY OF THE INVENTION**

10       Generally, the present invention contains a one-way standing valve holder  
11 and a one-way traveling valve holder. Contained within a shell of the standing valve  
12 holder are a nipple at the upper end and an intake tube at the lower end. A piston  
13 rod extends down from earth's surface to the traveling valve holder. At the lower  
14 end of the release tube is a piston. To form the water well pump, the piston end of  
15 the traveling valve holder is inserted into the nipple end of standing valve holder.  
16 Once inserted, the piston is aligned with a piston stop contained within the nipple.  
17 An elastic ball within the shell of the standing valve holder creates a one-way  
18 standing valve in the water well pump, and a hard ball within the piston of the  
19 traveling valve holder creates a one-way traveling valve in the water well pump.  
20 Surface equipment connected to traveling valve holder is used to reciprocate the  
21 traveling valve holder up and down using electric or manual power. During

1 reciprocation, the one-way valves open and close at alternating intervals to allow  
2 water to flow through the valves to ports on the release tube. Water released from  
3 ports travels upward within the confines of the riser pipe, filling it with water.  
4 Additional pumping causes the water to flow out of the top end of the riser pipe,  
5 where it can be collected, and put in a bucket or other suitable container. The  
6 present invention may also be used in an oil well.

7 In view of the foregoing, an object of the present invention is to provide a  
8 novel water well pump that reduces water hammer when the pump is used or is  
9 stopped. This is accomplished with hydraulic damping using a damper ring and  
10 with a collar attached to the inner portion of the shell where the elastic ball of the  
11 one way standing valve is located and with labyrinthine water passages.

12 It is another object of the present invention to provide a novel water well  
13 pump that prevents water leakage when a seat for the elastic ball is corroded or  
14 damaged. The present elastic ball is elastic and molds into any damaged areas of  
15 the seat to prevent water leakage.

16 It is another object of the present invention to provide a novel water well  
17 pump that contains an elastic or elastic ball that increases long-term functionality of  
18 the pump as well as decreases maintenance required. The offset balcony seat and  
19 the twist notch allows for even wear around the elastic ball as the ball gradually  
20 rotates about two axes.

21 It is another object of the present invention to provide a novel water well

1 pump that provides a multi-purpose support for the elastic ball. First, the support  
2 acts to underpin the elastic ball when it is at rest. Second, the support allows water  
3 to pass upward into the cylinder.

4 It is another object of the present invention to provide a novel water well  
5 pump that does not require adapters for connecting the piping components. A  
6 swaging process with solvent for the polymers is used to connect many of the  
7 components, which provides leak proof connections.

8 It is another object of the present invention to provide a novel water well  
9 pump with an automatic two axis ball rotator, which gradually rotates the ball so  
10 that it will last longer than the balls of the prior art.

11 It is another object of the present invention to provide a novel water well  
12 pump, which pumps with less force, less power, and less energy required to operate  
13 it by novel design, which does not require piston rings, nor piston cups nor any  
14 direct contact between the piston and the cylinder, held apart by the water space  
15 between the two.

16 It is another object of the present invention to provide a novel water well  
17 pump that is manually operable and operates quickly in the upward direction only  
18 and allows the user to rest as long as he/she wishes before pushing down slowly.  
19 This allows a single user to pump more water with this novel pump before becoming  
20 fatigued.

21 It is another object of the present invention to provide a novel water well

1 pump that has a strong support for the elastic ball, which serves to underpin it while  
2 also permitting the free flow of pump water through it.

3 It is another object of the present invention to provide a novel water well  
4 pump that is not angularly distorted during operation.

5 It is another object of the present invention to provide a novel water well  
6 pump that can be made without electricity if desired. This makes the pump useful  
7 in situations where electricity is not available such as for developing countries,  
8 remote villages, cottages, camping, field operations, or any type of emergencies.

9 It is another object of the present invention to provide a novel water well  
10 pump that contains a gravel plug and intake tube to protect the pump components  
11 from corrosion and debris that may interfere with the operation of the pump.

12 It is another object of the present invention to provide a novel water well  
13 pump that prevents water entering inside the hollow piston rod and will not leak  
14 water out of the top of it. This is accomplished with a plug at the end of the joining  
15 tube or at the end of the ball stop.

16 It is another object of the present invention to provide a novel water well  
17 pump that is easy to manufacture with simple hand tools and commonly used  
18 construction materials, such as Schedule 40 PVC piping or ABS piping.

19 It is another object of the present invention to provide a novel water well  
20 pump, which provides a built in hydraulic damper for the vibrations of the ball.

21 It is another object of the present invention to provide a novel water well

1 pump with a crude inexpensive riser pipe, which serves well to not only carry the  
2 water upward, but also serves as a good cylinder for the piston.

3 It is another object of the present invention to provide a novel water well  
4 pump, which provides a large, free flowing labyrinthine path for the water moving  
5 through, giving the benefit of reduced vibrations by utilizing the hydraulic damping  
6 of vibrations of any fluid in labyrinthine passageways.

7 It is another object of the present invention to provide a novel water well  
8 pump to precisely limit the ball travel to a few millimeters to obtain quicker closing  
9 of the valve.

10 It is another object of the present invention to provide a damping collar to  
11 reduce downward water flow to the underside of the elastic ball in its seat to reduce  
12 water hammer. Excessive flow caused by the design of the prior art increases water  
13 hammer.

14 It is another object of the present invention to provide a novel water well  
15 pump that can retain water for several months without leaking back through the  
16 valve once it is turned off. This would be beneficial for stripper wells.

17 These and other objects and advantages of the present invention will become  
18 apparent to one skilled in the art from the detailed description of the invention and  
19 the claims, with it understood that other configurations or substitutions of material  
20 may be used and are included within the scope of the claims of this invention.

21 **BRIEF DESCRIPTION OF THE DRAWINGS**



1           Fig. 1 is a cross section of the standing valve holder of the water well pump of  
2 the preferred embodiment of the present invention.

3           Fig. 2 is a cross section of the traveling valve holder of the water well pump of  
4 the preferred embodiment of the present invention.

5           Fig. 3 is a cross section of the standing valve holder of the water well pump of  
6 the second embodiment of the present invention.

7           Fig. 4 is a cross section of the traveling valve holder of the water well pump of  
8 the second embodiment of the present invention.

#### 9 10           **DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT**

11           Referring to Figs. 1 and 3, the standing valve holder of the water well pump  
12 of the preferred embodiment and of the second embodiment, respectively, of the  
13 present invention is shown. Referring to Figs. 1 and 3, standing valve holder 100  
14 contains a one-way standing valve 101. One-way standing valve 101 is composed  
15 of the lower end of piston stop 115, balcony seat 125, damper ring 120, twist  
16 notch 130, elastic ball 135, collar 140, main seat 145, and support 150, within  
17 shell 110.

18           Standing valve holder 100 contains an elongated shell 110 which is  
19 cylindrical having two open ends. Shell 110 is preferably fabricated of a high  
20 density polymer such as Schedule 40 PVC piping or ABS piping, but can be  
21 manufactured with any suitable material. In the preferred embodiment, shell 110

1 will have a 1 ½ inch inner diameter and will be about 13 cm in length. The two  
2 ends of shell 110 consist of an upper end 111 facing ground level and a lower end  
3 112 facing the Earth's center when positioned for use. Within the upper end 111 of  
4 shell 110 is a pipe nipple 105, which is cylindrical having two open ends. Nipple  
5 105 is preferably fabricated of a high density polymer such as Schedule 40 PVC  
6 piping or ABS piping, but can be manufactured with any suitable material. In the  
7 preferred embodiment, nipple 105 will have a 1 ¼ inch inner diameter and will be  
8 9 cm or less in length. Further, nipple 105 has an upper end 107 and a lower end  
9 108. Nipple 105 and shell 110 may have any desired inner diameter as long as  
10 nipple 105 is a size that does not fit into shell 110 without assistance.

11 Nipple 105 is force fitted into shell 110. This fit is provided without an  
12 adapter through the use of four slits 106 at the lower end 108 of nipple 105  
13 represented as hatch marks on Fig. 1 and Fig. 3. Slits alone would leak water,  
14 which is not acceptable. However, the present four slits 106 are compressible and  
15 when compressed are encased within shell 110 and are sealed against inner wall of  
16 shell 110. The four opposing tabs 121 as shown slide within shell 110 to allow the  
17 compression to occur. Without the four slits 106, such compression would not  
18 occur. When the nipple 105 is fit into shell 110 and released, the four slits 106  
19 will open slightly wedging nipple 105 within shell 110. Solvent welding is used for  
20 the polymer piping. Nipple 105 contains four slits 106, preferably 3 cm long or  
21 less. Four slits 106 allow the lower end 108 of nipple 105 to compress against the

1 upper end 111 of shell 110, which reduces the effective diameter of the outside of  
2 nipple 105. This reduction in diameter allows nipple 105 to be inserted partway  
3 into shell 110 to point F. In embodiment of Fig. 3, wide "V" marks 190 are  
4 provides to assist the mechanic during assembly to point F. A strong hydraulic  
5 press is used to insert the nipple 105, having adhesive, into shell 110 with  
6 considerable force past four slits 106 and short section 113 on nipple 105 to point  
7 F. Nipple 105 and shell 110 are held together in a press until the adhesive applied  
8 has set. Four tabs 121 of nipple 105 have enough contact strength with the shell  
9 110 to prevent nipple 105 from springing out of its engagement with shell 110.

10 The upper portion 181 of piston stop 115 is adjacent to the lower end 108  
11 of nipple 105. Piston stop 115 has an upper end 118 placed at the same height as  
12 upper end 111 of shell 110 and a lower end 117 that extends below nipple 105  
13 into the inner portion of shell 110. The upper end 118 of piston stop 115 connects  
14 to nipple 105 by pressing together with PVC solvent welding liquids. Piston stop  
15 115 is preferably made of Schedule 40 PVC or ABS piping, but can be made with  
16 any suitable material. The upper end 118 of piston stop 115 serves to limit the  
17 lower end 226 of piston 225 of traveling valve holder 200 when traveling valve  
18 holder 200 is placed inside riser pipe 109. Riser pipe 109 being in turn connected  
19 to standing valve holder 100 via pipe coupling 114, with standing valve holder 100.

20 Piston stop 115 together with balcony seat 125 functions as a ball cage at its  
21 lower end 117 by keeping elastic ball 135 near the center of the interior of shell

1 110, but slightly off center. The slightly off center placement of balcony seat 125  
2 as shown in Figs. 1 and 3 causes clockwise rotation of the elastic ball 135 of about  
3 1 mm, during each stroke cycle of the pump action. This serves as a one axis ball  
4 turner to distribute wear evenly over the elastic ball 135 surface.

5 Balcony seat 125 serves to precisely limit the upward travel of elastic ball  
6 135 in order to reduce vibrations. Balcony seat 125 is adjacent to the lower portion  
7 119 of piston stop 115 on the interior side and extends to the lower end 117 of  
8 piston stop 115. Balcony seat 125 attaches to piston stop 115 by solvent welding.

9 Balcony seat 125 is preferably constructed of Schedule 40 PVC piping or ABS  
10 piping. Balcony seat 125 is positioned within lower portion 119 of piston stop 115  
11 by way of one slit 183. Damper ring 120 is adjacent to the upper portion 126 of  
12 balcony seat 125 on the interior side and extends only partway down balcony seat  
13 125. Damper ring 120 is preferably constructed of Schedule 40 PVC piping or ABS  
14 piping, but can be constructed of any suitable material. Damper ring 120 is  
15 positioned within balcony seat 125 by way of one slit 182.

16 A twist notch 130 on balcony seat 125 directs turbulent flow of water  
17 differentially within standing valve holder 100 during down flow of water. During  
18 normal pump operation, piston 225 for this pump must be moved quickly upward,  
19 but is moved slowly downward. During one up stroke, a relatively larger amount of  
20 water, about 1/3 liter by actual test, passes up past elastic ball 135, but on the  
21 down stroke, only a tablespoon or two of water can pass by elastic ball 135 before it

1 snaps shut. Twist notch 130 causes a differential pressure on one side of elastic  
2 ball 135, i.e., the side with twist notch 130. The differential pressure will cause  
3 the ball to pitch up during each stroke cycle. As elastic ball 135 rolls clockwise 1 or  
4 2 mm in balcony seat 125 during up flow, the asymmetrical force during up flow  
5 and during down flow caused by twist notch 130 pitches elastic ball 135 upward.  
6 This causes an upward rotation of elastic ball 135 about 1/100 of a mm, making  
7 twist notch 130 act as another one axis ball turner. The axis of rotation is  
8 perpendicular to the first axis of rotation due to balcony seat 125. The combination  
9 acts together to cause elastic ball 135 to roll slightly and pitch slightly during each  
10 stroke cycle of the pump action. This acts together to rotate elastic ball 135 during  
11 normal operation for uniform wear around the surface of elastic ball 135. This  
12 allows elastic ball 135 to wear evenly over its surface to increase durability and  
13 reduce maintenance of water well pump 50.

14       Hydraulic damping is provided by damper ring 120, which acts much like an  
15 automotive shock absorber. The velocity of flow of liquid through the orifice 131 is  
16 retarded. Damper ring 120 is below ports 116 in piston stop 115. The orifice 131  
17 of damper ring 120 restricts rapid flow of water during both upward and downward  
18 flow and creates turbulence of water on the side of the orifice 131 opposite the  
19 direction of flow. The retardation of water flow down through orifice 131 does not  
20 allow a heavy hit down on elastic ball 135, but instead is a light hit. Less water  
21 with less velocity hits down on upper surface 132 of elastic ball 135. More water

1 velocity is diverted left and right through ports 116. Elastic ball 135 having a  
2 lighter downward hit is not able to bounce back as high as for a larger hit. Smaller  
3 bounce means smaller water hammer. This is a working solution to a significant  
4 water hammer problem. Early models of pumps with elastic balls bounce (hammer)  
5 so strongly that the bouncing ball continues to hammer until pumps empty  
6 themselves of all water. The features of this invention give test results that do not  
7 empty the pump of water, but rather quickly shut off any pump water that might  
8 escape downward. Restricted orifice 131 brings about increased lateral flow  
9 through ports 116 and reduces longitudinal flow of water. The loss of kinetic energy  
10 in the longitudinal flow causes elastic ball 135 to reduce its hit downward and this  
11 reduces bounce back. Therefore, damper ring 120 reduces what is commonly  
12 called water hammer or an unwanted noisy and shaking of the water well pump 50,  
13 during each cycle of the reciprocal stroke action.

14 Collar 140 is adjacent to shell 110 on the inner surface of shell 110. Collar  
15 140 is positioned within shell 110 by way of one slit 184. Collar 140 is preferably  
16 constructed of Schedule 40 PVC or ABS piping, but can be constructed of any  
17 suitable material. Collar 140 also helps to reduce water hammer. During the  
18 normal pumping of any reciprocal pump, there are moments of up flow and  
19 moments of down flow. During down flow, the water from ports 116 in piston stop  
20 115 encounters the upper surface 141 of collar 140. Because of this, the water is  
21 unable to move straight downward to get underneath elastic ball 135. Therefore,

1 the water is deflected laterally toward the center of standing valve holder 100 with  
2 turbulence caused by laterally opposing flows of water from the opposing side of  
3 standing valve holder 100. This lateral flow of water transforms the kinetic energy  
4 from longitudinal kinetic energy to lateral kinetic energy, which decreases the  
5 amount of fast moving water that can get under elastic ball 135 as elastic ball 135  
6 seats itself in main seat 145. This transformation to lateral kinetic energy reduces  
7 water hammer by reducing the excess bouncing of elastic ball 135; collar 140  
8 further increases the length of labyrinthine passageway to slow down the flowing  
9 water. With low water pressure under elastic ball 135 and high water pressure  
10 above elastic ball 135, any vibrations ("hammer") quickly reduce to null according  
11 to actual test results.

12 Elastic ball 135 is situated within the center of shell 110 within collar 140  
13 creating the one-way standing valve 101. Elastic ball 135 is preferably made of an  
14 elastic rubber such as silicone rubber. Elastic ball 135 does not have to be made of  
15 a homogenous material. Therefore, for greater depths, elastic ball 135 may be  
16 made of steel with a rubber coating. Elastic ball 135 sits on top of main seat 145  
17 over a top opening of main seat 145 formed by rounded side 180. Elastic ball 135  
18 is flexible and can conform to a damaged main seat 145. Main seat 145 may be  
19 damaged from the constant impact of elastic ball 135, erosion from abrasives,  
20 corrosion, chipping, or flaking. Traditional steel balls would be unable to seal the  
21 standing valve holder 100 to prevent unwanted water leakage. However, elastic ball

1 135 will prevent unwanted water leakage because the water pressure pushes the  
2 soft, elastic material of elastic ball 135 into the damaged or chipped places of main  
3 seat 145. Therefore, the only leakage past elastic ball 135 will be individual  
4 molecules of water due to heat vibrations of molecules within the water.

5 Elastic ball 135 additionally requires support 150. The lower end 151 of  
6 support 150 is fitted within the upper end 158 of an intake tube 155. The upper  
7 portion 186 of support 150 has three orifices 185, but the exact number of orifices  
8 185 is optional, for allowing the passage of water through the one-way standing  
9 valve 101. The sides of support 150 have three additional orifices 188, but the  
10 exact number of orifices 188 is optional, to allow easy passage of water upward.

11 Intake tube 155 in turn is fitted within main seat 145. Support 150 connects to  
12 intake tube 155 by solvent welding of the polymers. Support 150 is preferably  
13 constructed of Schedule 40 PVC or ABS piping, but can be constructed of any  
14 suitable material. Support 150 is required to prevent elastic ball 135 from  
15 compressing itself due to its elasticity and from jamming itself tightly in the top  
16 opening of main seat 145. If elastic ball 135 were to force itself through the top  
17 opening of main seat 145 during pumping, the water well pump 50 would become  
18 completely inoperative. Therefore, support 150 serves to underpin elastic ball 135  
19 when elastic ball 135 is at rest. Support 150 also allows water to pass through  
20 support 150. When water flow is upward, water flows upward through orifices 185,  
21 188 of support 150, lifts ball, and flows up past the lifted elastic ball 135 and



1 further upward through ports 116 and further upward through nipple 105 into riser  
2 pipe 109. When water flow is shut off, elastic ball 135 seals top opening of main  
3 seat 145. Therefore, support 150 functions as a superb brace for elastic ball 135  
4 while also allowing easy flow of water upward through the many orifices 185, 188  
5 of support 150, as shown in Figs. 1 and 3.

6 The main functions of intake tube 155 are to provide a mechanism for  
7 straining out small bits of gravel and other debris from water well pump 50 and to  
8 provide a foundation for support 150. Intake tube 155 is adjacent to the bottom  
9 portion 187 of main seat 145 and extends below shell 110. Intake tube 155  
10 attaches to main seat 145 by solvent welding of polymer in the usual way. Intake  
11 tube 155 is preferably constructed of Schedule 40 PVC or ABS piping, but can be  
12 constructed of any suitable material. The lower end 112 of shell 110 forms a  
13 shield over the four intake holes 156 on intake tube 155 thus creating a circular  
14 water channel 189 between lower end 112 of shell 110 and intake tube 155. This  
15 water channel 189 is narrow but long. The narrowness of it keeps gravel away from  
16 entering the larger intake holes 156 to protect the pump mechanisms from gravel,  
17 or other debris. The four intake holes 156 join with four slits 157 on intake tube  
18 155 to form a continuous passage way for water into water well pump 50 shielded  
19 from debris by shell 110.

20 Gravel plug 160 is at the bottom end of intake tube 155. Gravel plug 160 is  
21 preferably constructed of Schedule 40 PVC or ABS piping and solvent welded in

1 intake tube 155. The main function of gravel plug 160 is to prevent trash or other  
2 solid debris contained in the incoming water from entering the water well pump 50.

3 Any sand that does get past gravel plug 160 will collect within intake tube 155 on  
4 top of gravel plug 160. Reciprocal sloshing action of the water during the stroke  
5 cycle of the pump action will allow excess sand to be expelled through four slits 157  
6 out of water well pump 50.

7 Several differences from the preferred embodiment of standing valve holder  
8 100 of Fig. 1 are shown in the second embodiment of Fig. 3. First, shell 110 will  
9 have the same inner diameter, but will be 12 cm long. Nipple 105 will have the  
10 same inner diameter but will be 7 cm long. Second, upper end 161 of gravel plug  
11 160 contains slits 162. Slits 162 provide a connecting means to allow a force fit of  
12 gravel plug 160 into the lower end 159 of intake tube 155; solvent welding is used  
13 in the usual way. Slits 162 also provide a limited passageway for water into intake  
14 tube 155 while also preventing large debris from entering water well pump 50.

15 Further, in line with point F on nipple 105 are two wide "V" marks 190 made in the  
16 shape of a pronounced "V" which provide location assistance to the mechanic when  
17 he is pressing the assembly together as he reaches point F. The pronounced "V"  
18 design is necessary to identify depth of engagement during pressing of components.

19 During application of the solvent to nipple 105 up to the wide "V" marks 190, it  
20 dissolves the apex of the wide "V" marks 190, but the wide "V" allows the  
21 mechanic to extrapolate with his eyes the location of the apex of the "V" which

1 disappeared during application of the solvent. This improvement serves to allow for  
2 exact placement of nipple 105 into shell 110 during normal assembly of water well  
3 pump 50.

4 Referring to Figs. 2 and 4, the traveling valve holder 200 of the preferred  
5 embodiment and second embodiment, respectively, of the present invention are  
6 shown. In Fig. 2, the traveling valve holder of the water well pump of the preferred  
7 embodiment of the present invention is shown. Traveling valve holder 200 generally  
8 contains an elongated joining tube 210, an elongated release tube 220, and a  
9 piston 225. Release tube 220 is cylindrical with two open ends and preferably  
10 constructed of a high density polymer such as Schedule 40 PVC piping or ABS  
11 piping, but can be constructed of any suitable material. In the preferred  
12 embodiment, release tube 220 will have a  $\frac{3}{4}$  inch inner diameter and will be 12.5  
13 cm in length. The bottom end 221 of release tube 220 is cut at a 45° angle.  
14 Within release tube 220 is a shorter elongated joining tube 210. Joining tube 210  
15 is cylindrical with two open ends and preferably fabricated of a high density polymer  
16 such as Schedule 40 PVC piping or ABS piping, but can be manufactured from any  
17 suitable material. In the preferred embodiment, joining tube 210 will have a  $\frac{1}{2}$  inch  
18 inner diameter. Joining tube 210 connects to the hollow piston rod 211 (shown in  
19 phantom line), which extends from the water well pump 50 to the surface  
20 equipment (not shown) used to reciprocate traveling valve holder 200 or it can be  
21 manually reciprocated by a human being. Release tube 220 and joining tube 210

1 may have any desired diameter as long as the diameter is small enough to allow free  
2 passage of water upward between release tube 220, piston rod 211, and riser pipe  
3 109. The upward flow of water is in the usual way of flow of water through riser  
4 pipe 109.

5       Joining tube 210 is force fitted with release tube 220. This fit is provided  
6 without an adapter through the use of slits 205 (Fig. 2) and slits 206 (Fig. 4). In  
7 Fig. 4, the two slits 205 of joining tube 210 are in a clock position 90 degrees away  
8 from the two slits 206 of release tube 220. Thus, the surface of joining tube 210  
9 covers over the slits 206 to prevent water leak. The surface of release tube 220  
10 covers over the slits 205 of joining tube 210 in this way, due to the 90 degree  
11 clocked position. The four slits 205, 206 are covered over and do not leak.

12       Slits alone would leak water, which is not acceptable. However, the present  
13 slits 205 are compressible and when compressed, are encased within piston rod  
14 211 and are sealed against the inner wall of piston rod 211. The two opposing slits  
15 205 as shown allow the compression to occur. Without the slits 205, such  
16 compression will not occur. The joining tube 210 contains four slits 205 in Fig. 2,  
17 and contains two slits 205 in Fig. 4. Slits 260 allow ball stop 230 to compress  
18 against the bottom end 221 of release tube 220 and bonding of Fig. 4 embodiment.

19       Slits 205 allow joining tube 210 to compress against the upper end 222 of release  
20 tube 220, which reduces the effective diameter of the outside of joining tube 210.  
21 This reduction in diameter allows joining tube 210 to be inserted partway into

1 release tube 220 to point G. Further, in line with point G on joining tube 210 in the  
2 Fig. 4 embodiment are two wide "V" marks 290 which provide location assistance  
3 to the mechanic when he is pressing the assembly together as he reaches point G.  
4 A strong hydraulic press is used to insert joining tube 210 into release tube 220  
5 with solvent welding of the polymer material. A plug 215 is simultaneously  
6 mechanically bonded into the lower portion 223 of joining tube 210 in Fig. 4; this  
7 plug blocks unwanted water flow up the joining tube 210. In Fig. 4, plug 215 is  
8 pressed into upper end of ball stop 230. In both Figs. 2, 4, plug 215 is installed  
9 with solvent on it. Upper end 222 of release tube 220 may have a bevel edge  
10 adjacent to joining tube 210 and a chamfer edge on the outside of release tube  
11 220; bevel edges and chamfer edges may be used to facilitate pressing the parts  
12 together. Lower portion 223 contains a region 224 that does not contain slits in  
13 Fig. 2, so this region 224 would not be compressible. Plug 215 is preferably a  
14 small hard ball, such as a marble, but can be any suitable material. Plug 215 is  
15 bonded to joining tube 210 in three ways.

16 First, bonding occurs by friction. Region 224 is rigid and plug 215 can be  
17 popped into place using PVC solvent on it before insertion into release tube 220.  
18 Once joining tube 210 is fit into release tube 220, the tight fit holds the plug 215  
19 into place. Second, bonding is due to mechanical interference of the swaged end of  
20 joining tube 210. As mentioned, slits 205 allow compression of the sides of joining  
21 tube 210 to allow pressing it into release tube 220 using solvent welding of the

1 polymers. This is the third bonding. Wide "V" marks 290 assist the mechanic in  
2 assembling joining tube 210 into release tube 220 of Fig. 4; wide "V" marks 290  
3 are used to show exact location on point G.

4 Bonding occurs by application of PVC solvent or other adhesive before and  
5 after plug 215 is inserted into joining tube 210. Joining tube 210, release tube  
6 220, and plug 215 are held together in the hydraulic press until the PVC solvent  
7 has set. Piston rod 211 (shown in phantom line) is connected to upper end 281 of  
8 joining tube 210 and would be used to cause traveling valve holder 200 to  
9 reciprocate or stroke up and down. This reciprocation may be accomplished  
10 manually, with an electric motor, or by any other suitable means.

11 The bottom end 221 of release tube 220 is surrounded by a piston 225.  
12 During pump operation, piston 225 fits inside riser pipe 109. The fit of piston 225  
13 inside riser pipe 109 is a slip fit similar to the slip fit of the piston and cylinder of an  
14 automobile engine (not shown) except piston 225 requires no piston rings and is a  
15 deliberate loose fit within riser pipe 109. Riser pipe 109 serves two functions: one  
16 as a conduit for upward flowing water and two, as the cylinder for piston 225. The  
17 main function of piston 225 is to provide a means for lowering the water pressure  
18 below piston 225 during rapid upward lift of piston 225, and raising the water  
19 pressure below piston 225 during low downward push of piston 225. This  
20 alternating pressure causes elastic ball 135 to alternately rise and fall and hard ball  
21 240 to alternately fall and rise, in the usual manner of check valves, the process of

1 which causes the water to move upward in the normal way through any pipe.  
2 Piston 225 is cylindrical with two ends and is force fit with release tube 220.  
3 Piston 225 is preferably constructed of Schedule 40 PVC or ABS piping, but can be  
4 constructed of any suitable material. Within piston 225 is a hard ball 240 providing  
5 the one-way traveling valve 201. Hard ball 240 can be made of glass, steel, or of  
6 any suitable material. Slits 235 are provided to allow placement of release tube  
7 220 into piston 225. Slits 235 allow release tube 220 to compress against the  
8 upper end 229 of piston 225, which reduces the diameter of release tube 220  
9 allowing it to fit within piston 225. This reduction in diameter allows release tube  
10 220 to be inserted into piston 225 to point H. Further, in line with point H on  
11 release tube 220 are two wide "V" marks 291 of Fig. 4, which provided location  
12 assistance to the mechanic when he is pressing the assembly together as he reaches  
13 point H. A portion 228 of release tube 220 will be fit into piston 225 even though  
14 it contains no slits 235. Release tube 220 is self-aligning due to the tight fit of at  
15 least 1 cm of solid release tube 220 above the three slits 235 of Fig. 2 or one slit  
16 235 of Fig. 4. This simultaneously provides a bevel of 45° that pushes hard ball  
17 240 to the side every time traveling valve holder 200 is reciprocated. The 45° bevel  
18 serves to rotate hard ball 140 in the clockwise direction.

19 A ball stop 230 is connected to release tube 220 to provide angled  
20 movement of hard ball 240 and to stop further upward movement of hard ball 240.  
21 Ball stop 230 is connected to release tube 220 by solvent welding or other

1 adhesive. Ball stop 230 is preferably constructed of Schedule 40 PVC or ABS  
2 piping, but can be constructed of any suitable material. Hard ball 240 is preferably  
3 made of a glass material such as in the "marble", a boy's or girl's toy, but can be  
4 made of any suitable material. Ball stop 230 can deflect hard ball 240 out of the  
5 path of flowing water while simultaneously providing four concurrent paths for flow:  
6 1) a cut-a-way of 1 cm of the release tube 220 at the slit 235; 2) a  $\frac{1}{4}$  inch  
7 diameter hole drilled through both the ball stop 230 and release tube 220, near the  
8 point located by the pointer of bottom end 221 of release tube 220, and connected  
9 by cut-a-way to the adjacent open space; 3) two creases, one on each side of hard  
10 ball 240 along the 45° cut angle; and 4) the inner diameter of ball stop 230 itself,  
11 which is open for the upward flowing water.

12 Hard ball 240 is positioned over a bushing 245 and a stool 250. Bushing  
13 245 is adjacent to the inner portion of piston 225 directly below the bottom end  
14 221 of release tube 220. Bushing 245 is force fit with piston 225 by way of one  
15 slit 241 and bonded with solvent welding or other adhesive. Bushing 245 is  
16 preferably constructed of Schedule 40 PVC or ABS piping, but can be manufactured  
17 from any suitable material. Stool 250 is adjacent to the inner portion of bushing  
18 245 and is slightly shorter than bushing 245. Stool 250 is force fit with bushing  
19 245 by way of one slit 246 and bonded in a like manner. Stool 250 is preferably  
20 constructed of Schedule 40 PVC or ABS piping, but can be constructed of any  
21 suitable material. Bushing 245 and stool 250 serve to support hard ball 240 and



1 seal the one-way traveling valve 201. To achieve a perfect fit for hard ball 240,  
2 bushing 245 and stool 250 are modified with exact measurement slit 241 and  
3 exact measurement slit 246. Therefore, upon compression in piston 225, both  
4 bushing 245 and stool 250 will perfectly fit into piston 225 and will close up slit  
5 241 and slit 246, and prevent unwanted leaks, and will hold with great strength  
6 with the bonding liquid used during manufacture and provides a secure fit to hard  
7 ball 240. The bottom ends of piston 225, busing 245 and stool 250 are aligned at  
8 the same point to form the bottom 280 of traveling valve holder 200.

9         Several differences from the preferred embodiment of the traveling valve  
10 holder 200 in Fig. 2 are shown in the second embodiment of Fig. 4. Release tube  
11 220 contains two slits 206 which allow the force fit between release tube 220 and  
12 joining tube 210. Further, joining tube 210 extends down to the upper end 227 of  
13 ball stop 230 in Fig. 4, but not to upper end 227 of ball stop 230 in Fig. 2. The  
14 bottom end 261 of ball stop 230 is cut at a 45 degree angle in both embodiments  
15 of Fig. 2 and Fig. 4. Ball stop 230 contains slit 260 on bottom ends 261 to force  
16 fit with release tube 220. In addition, plug 215 is bonded inside ball stop 230 of  
17 Fig. 4 embodiment but not in ball stop 230 of Fig. 2 embodiment. Joining tube  
18 210 of Fig. 4 ends at the top of ball stop 230 as shown in Fig. 4. In Fig. 4  
19 embodiment, ports 255 are cut through both ball cage 230 and release tube 220 to  
20 allow water to flow out and upward within the riser pipe 109 in the usual way of  
21 water through a pipe. In both Fig. 1 and Fig. 3, nipple 105 is connected to riser

1 pipe 109 using pipe coupling 114 with solvent welding. Pipe coupling 114 is  
2 shown shorter than actual size for purpose of diagram. Riser pipe 105 acts as the  
3 cylinder to piston 225, and riser pipe 105 serves the second function as conduit for  
4 the water, and serves the third function of being the structural support of the  
5 standing valve holder 100, supporting the weight of pipes and water inside.

6 The operation of the water well pump 50 is believed to be readily  
7 understandable to those skilled in the art from the foregoing description. However,  
8 briefly, water well pump 50 is submersed into a water well (not shown). Human  
9 manpower or surface equipment (not shown) reciprocates traveling valve holder 200  
10 into standing valve holder 100 in an up and down manner using hollow piston rod  
11 211 to transmit the motion. Piston rod 211 extends to the surface from water well  
12 pump 50. Reciprocation is allowed through piston 225 moving within riser pipe  
13 109, which also serves as cylinder, upward 1 meter and downward to piston stop  
14 115. When traveling valve holder 200 reciprocates slowly downward, elastic ball  
15 135 will drop and close standing valve holder 100, and hard ball 240 will rise  
16 opening traveling valve holder 200 allowing water in riser pipe 109 to move up past  
17 hard ball 240. When traveling valve holder 200 reciprocates quickly upward,  
18 elastic ball 135 rises allowing water from intake tube 155 to move up past elastic  
19 ball 135 and enter nipple 105. During the next reciprocation downward, hard ball  
20 240 again rises opening traveling valve holder 200 and water again flows up release  
21 tube 220 and out ports 255 and again into nipple 105 and riser pipe 109. The

reciprocation of traveling valve holder 200 is repeated up and down to pump water from the ground, through riser pipe 109, filling riser pipe 109 until it is full, at which time additional pumping causes water to overflow out the top end of riser pipe 109, which water can be collected, and put into a bucket or other suitable container.

Although the invention has been described with reference to specific embodiments, this description is not meant to be construed in a limited sense. Various modifications of the disclosed embodiments, as well as alternative embodiments of the inventions will become apparent to persons skilled in the art upon the reference to the description of the invention. It is, therefore, contemplated that the appended claims will cover such modifications that fall within the scope of the invention.